

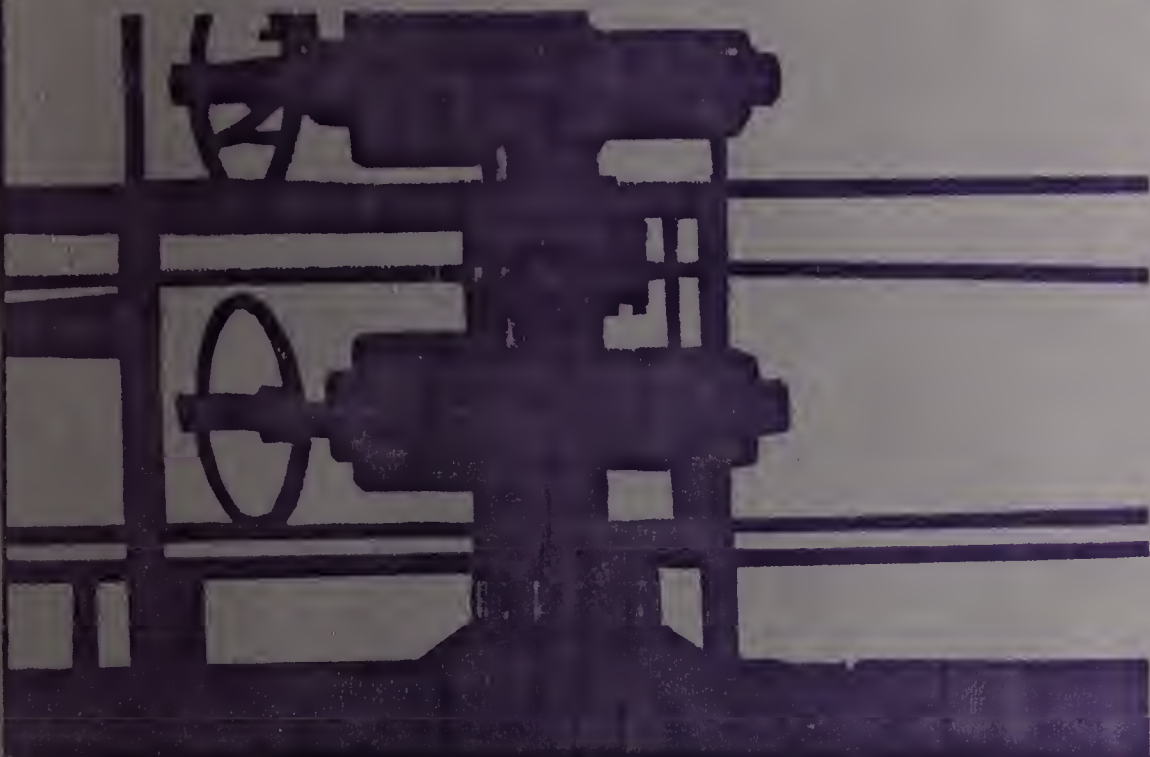
RILEY RIDGE NATURAL GAS PROJECT

EXXON LABARGE PROJECT

ELK WILDLIFE STUDY REPORT

1979-1987

DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT
DEPARTMENT OF AGRICULTURE
FOREST SERVICE



RESPONSE OF ELK TO DEVELOPMENT OF A NATURAL GAS FIELD IN WESTERN
WYOMING 1979 - 1987.

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A large reserve of natural gas, known as the Riley Ridge Gas Field, was discovered in the 1960s in the Wyoming Range in western Wyoming. Exxon Company, U.S.A. controls leases on 48,000 acres of this gas field and completed Phase I of their two phase development plan for gas recovery in 1986. Their project, the LaBarge Project, is on elk summer, winter, crucial winter and calving ranges (figure 1).

When Exxon drilled a discovery well in 1978-79 on an elk calving area in Snider Basin, there was concern that the well would adversely affect elk calving and distribution. A schedule was developed to avoid impacts by completing drilling prior to calving season. However, problems delayed well completion and drilling continued through the calving season in 1979. In the spring of 1979, a monitoring program was established to assess elk response to drilling, and monitoring continued through the 1980 calving season, when there was no activity in Snider Basin. In 1979 and 1980, about 100 hours were spent on flights to document elk distribution within Snider Basin and throughout the rest of the Piney Elk Herd. The study showed that elk moved calves at an earlier age in 1979 than in 1980, avoided meadows visible from roads with high traffic volumes more in 1979 than in 1980 and avoided the drill site in 1979 (Johnson, B.K. and D. Lockman. 1980. Response of elk during calving to oil/gas drilling activity in Snider Basin, Wyoming. 14 pp. in District I Annual Big Game Herd Unit Reports, Piney Elk Herd.)

From 1981 through 1983, elk distribution throughout the Riley Ridge Gas Field was documented in anticipation of field development of this reserve. Both airplane and helicopter flights were made during spring and winter and elk were captured, ear tagged and neck-banded at Finnegan Feedground. In 1984, Exxon began development of their gas leases and the monitoring program intensified. Flights for elk distribution increased in frequency with particular attention given to the Rock Creek/Graphite Hollow and Riley Ridge winter ranges and to the Lake Ridge and Snider Basin calving areas. Activities associated with field development peaked in 1985 and the field began production in 1986. The monitoring program continued through the winter of 1986-87 and ended in May 1987.

This report summarizes 1979 through 1987 monitoring of elk distribution and use of the Rock Creek/Graphite Hollow and Riley Ridge winter ranges, and Lake Ridge and Snider Basin calving areas. Changes in distribution and decline in elk numbers on winter ranges are documented and discussed.

Acknowledgments

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AREAS MONITORED/METHODS

Winter Range Description

Graphite Hollow/Rock Creek

The Rock Creek/Graphite Hollow winter range on the south end of Deadline Ridge, contains portions of two drainages. Graphite Hollow contains about 16,000 acres of crucial winter range consisting of a series of wind-swept, snow-free ridges. Vegetation is dominated by sagebrush (Artemisia spp.) or mixed grass stands with a few isolated aspen (Populus tremuloides) stands. Conifer cover, lodgepole pine (Pinus contorta), limber pine (P. flexilis) and Douglas fir (Pseudotsuga menziesii), is limited to the head of Graphite Hollow. Rock Creek contains about 8,000 acres of crucial winter range. Wind-blown, snow-free slopes provide foraging areas, and mixed conifer, aspen and curlleaf mountain mahogany (Cercocarpus ledifolius) stands provide cover. Elevation of both drainages is from 7,200 to 9,600 feet above sea level.

The highest number of elk observed on this winter range was 400 seen during aerial trend counts in 1968 (unpublished data, District I files). Since 1979, aerial trend counts of elk numbers and distribution have been obtained each winter from either an airplane or helicopter.

Elk Distribution

Elk distribution on this winter range was determined by aerial and ground reconnaissance from 1979-1983, and by aerial and ground reconnaissance from November 1, 1984 through May 19, 1985,

November 1, 1985 through May 16, 1986 and December 12, 1986 through May 6, 1987. Data collected in these years provided information on elk distribution before drilling (winters 1979-1983), during drilling (winter 1984-85), while completion and workover rigs were active, (November-December 1985), when there was no activity (January-May 1986), and during production (winter 1986-87).

Observations of elk distribution on the Graphite Hollow winter range from 1984-1986 were compared to elk distribution on this winter range from 1979-1984. Distances of elk sightings from Graphite Well 2-15 and numbers of sightings within Rock Creek vs. Graphite Hollow were determined for pre-drilling, drilling, and production periods.

Well Drilling and Production

Graphite Well 2-15, drilled and completed from October 1984 - December 1985, was at the head of Graphite Hollow on crucial elk winter range (NW1/4 NE1/4, Sec. 21, T27N, R114W). The drill pad was located in an aspen-lodgepole stand, separated from the nearest windswept slope by about 50 feet of small aspen tree cover. The drilling rig was visible from most locations in Graphite Hollow and noise associated with the drilling activity was audible throughout this winter range.

Gas flow testing on Graphite Well 2-15 was completed December 19, 1986 and occasional human activity continued at the well site until the end of January 1986 when snow was no longer plowed from the road. Work to reopen the road was initiated in April 1986, and this well was placed into production in August 1986. Human activities associated with well service and maintenance continue at least twice per week and may occur daily if necessary.

Elk Radio Collaring

In March 1984, Exxon proposed to drill Graphite Well 2-15 in 1986. Sixteen radio collars were to be placed on elk to obtain distribution information in 1984-85 for comparison to distribution data from these elk during drilling activity in 1985-86. Exxon accelerated its drilling schedule, however, and drilling started in October 1984, leaving no opportunity to trap and radio-collar elk prior to drilling. As a result, the monitoring program was revised.

In an attempt to document movements within the Graphite Hollow and Rock Creek winter ranges and fidelity to the winter range between years, elk trapping was conducted in winter 1985-1986. Clover traps were placed on Rock Creek during the fall and trapping was initiated in January 1986. Efforts were made to minimize human disturbance at the trapsites. Radio transmitters affixed to the traps emitted a signal when the trap was closed. Traps were set for 3-5 days, then closed for 5-7 days to allow elk undisturbed access to portions of the winter range near the trap site. Trapping was not conducted in Graphite Hollow to avoid harassing elk away from the drill site. Seven elk were trapped on Rock Creek during 22 nights of trapping (88 trap nights), and radios were attached to four of these animals

(Table 1). Summer distribution, movement on this winter range, and fidelity to the winter range were determined by relocating radios from aircraft.

Lake Ridge Calving Area

The Lake Ridge calving area consists of east-west ridges bisected by steep-sided drainages. North aspects support conifers and south aspects support grass and sagebrush stands. East aspects and flat areas contain aspen or wet meadow stands. This area contains an ideal calving mosaic of aspen, conifer, wet meadow, grass and forb, and sagebrush stands. Elk distribution during calving season (May 15-July 15) was determined by aerial reconnaissance from 1984-1987 and compared to pre-drilling distribution of elk obtained from 1979-1983.

Snider Basin Calving Area

The calving area in Snider Basin is a mosaic of aspen, lodgepole pine, willow (*Salix* spp.), sagebrush and grasses. The basin is surrounded by Riley Ridge on the east, Deadline Ridge on the south, Packsaddle Ridge to the west and Darby Mountain on the north. Elevation of the basin is 8,000 to 10,000 feet. of Riley Ridge is 9,828 feet. An exploratory well was drilled by Exxon in Snider basin in 1978-79, but from 1980 to 1983, there was no drilling activity in Snider Basin during elk calving. In 1983, Exxon began drilling well 2-28 on Packsaddle Ridge, and well 3-15 was started in the spring of 1984 near the Snider Basin Guard Station (Figure 2).

Elk distribution and habitat use during calving were determined in 1979 and 1980 in a study of elk response to the exploratory well (Johnson and Lockman, op cit).

Aerial reconnaissance and pellet transects were used to estimate elk use and distribution in Snider Basin during calving in 1984, 1985 and 1986. Six pellet transects, consisting of 10 circular 0.01 acre plots, were located in Snider Basin in 1979 and 1980. These transects, reestablished in 1984, were examined in early July each year from 1984-86 to estimate elk use of the basin during calving season. Aerial flights were made to document distribution and to obtain minimum estimates of elk numbers in the Basin during calving. These data were compared to data collected in 1979 and 1980 to estimate changes in elk numbers and distribution.

Riley Ridge Winter Range

The Riley Ridge winter range consists of Riley, Reed and Trail Ridges. These east-west, grass-covered ridges are windblown and snow-free most years. North aspects of the ridges are covered by conifer stands and south aspects are covered by aspen, sagebrush or mixed shrub stands. Crucial elk winter range occurs on Riley, Reed, and Trail Ridges. Winter elk distribution on those ridges was documented from the air in 1977 and from 1980-1987. American Quasar Corporation drilled one well in 1980, and three wells in 1981 on Riley Ridge. Distribution and movements of elk were compared before,

during, and after drilling. Before and after drilling, there was no human activity on Riley Ridge in winter because access was limited by private landowners and no roads were plowed. As of December, 1986, Exxon Company, U.S.A. controlled leases only on Trail Ridge.

RESULTS

Elk Distribution

Graphite Hollow/Rock Creek

Distribution of elk on the Graphite Hollow/Rock Creek winter range was different during drilling and production than before drilling. The number of elk using this winter range has declined since drilling was initiated. From November 1, 1979 - May 84, 1,377 elk were observed on 76 occasions on the Graphite Hollow/Rock Creek winter range. Before drilling, 52 groups of elk sighted (76%) totalling 1,066 animals (80%) were in Graphite Hollow. During drilling in 1984-85, only 15 of 17 groups of elk (32%) and 572 of 1,484 elk observed (39%) were in Graphite Hollow (Table 2). During the well completion period, November-December 1985, one of 4 groups of elk (25%) and 25 of the 175 elk observed (11%) were in Graphite Hollow. During production in 1986-87, 2 of 3 groups of elk (67%) and 52 of 168 elk (24%) were observed in Graphite Hollow (Table 2). From January-April 1986, when there was little or no activity at the well site and the road was not plowed, 8% of the 22 groups of elk (32%) and 293 of 648 elk (45%) were observed in Graphite Hollow. Small groups of elk were scattered in Rock Creek and a few large groups of elk were seen in Graphite Hollow (Table 3) when there was no activity at the wellsite.

Section 21 of Graphite Hollow

Graphite Well 2-15 was drilled adjacent to Section 21, which received heavy elk use from 1979-84. Elk use of Section 21 at the head of Graphite Hollow and areas adjacent to the drilling rig was less from November 1984-May 1987 than November 1979-May 1984. From 1979-84, elk were observed in Section 21 on 47% of the elk survey days in Rock Creek or Graphite Hollow (Table 4). During well drilling in 1984-85, elk were observed using Section 21 on only 11% of the survey days. From December 1985-January 1986, when well completion work was ongoing, during 3 flights only 1 group of 26 elk was observed in Section 21. After the road was closed, 77 elk were observed in Section 21 on 2 of 5 flights. Elk distribution during the lull in wellfield activity was began to resemble elk distribution prior to field development.

In 1985-86, 103 of 895 elk observed during 3 of 33 observations (12%) were in Section 21, adjacent to Graphite Well 2-15. In 1986-87, 23 of 220 elk observed (10%) during one of 3 observations were in Section 21.

When Graphite Well 2-15 was being drilled in 1984-85, there were no elk within 1/2 mile of the well and only 4% of the elk sightings were between 1/2 and 1 mile of the rig. Prior to drilling from 1979-84, 11 of 76 groups of elk sighted (14%) were within 1/2 mile of the well and 10 more groups (13%) were 1/2 to 1 mile from the well (Table 5). Observations of elk in Sections 22 and 27, adjacent to Section 21, show similar declines in use during drilling (Table 5, Figures 3 and 4). On 28% of the flights, elk were observed in Sections 21, 22, or 27 in 1984-85. From 1979-84, elk were observed in these sections on 67% of the flights. Percent occasions that elk were observed within 2 1/2 miles of the well site in Graphite Hollow declined 59% during drilling. Within 1 mile of the well, there were 86% less occasions when elk were seen during drilling than before drilling.

Elk winter distribution in 1985-86 was similar to that in 1984-85 when the well was being drilled. Elk were observed on 40 occasions in 1985-86 and on 73% of these occasions, elk were in the Rock Creek drainage. In 1984-85, elk were observed using Rock Creek on 68% of 56 occasions. This elk distribution is opposite that observed from 1979-1984, when elk were observed in Graphite Hollow 68% of the time. In 1984-85, no elk were seen within 1/2 mile of the well location. In 1985-86, observations of elk near the well site were made after the well was completed (Table 2). Elk were observed within 1/2 mile of the well site on January 4, April 17 and May 1, 1986 (Table 3).

During the winter of 1986-87, elk were observed using Graphite Hollow on March 21 and April 15. Exxon had limited activity at the well site to daily trips in over-snow vehicles (i.e. Thiokol, Muskeg) between 10:00 am and 3:00 pm. Usually, only one trip was made for well service and trips were not always made every day.

Rock Creek Drainage

Elk use of Rock Creek increased during drilling in Graphite Hollow. The Rock Creek drainage is separated from Graphite Hollow by a dense stand of lodgepole pine between the east ridge above Rock Creek and the west edge of Graphite Well 2-15. In 1984-85, 68% of all elk groups observed were in Rock Creek during drilling, an increase of 113% from the pre-drilling distribution. Elk were separated from drilling activity by 1 mile of conifer cover and were located below a ridgeline. Most of the elk sightings were made in Section 17. In 1985-86, 73% of the observations of elk were in the Rock Creek drainage. In 1986-87, the most elk observed on any one flight was 29 in Graphite Hollow and 168 in Rock Creek. These totals were on different days and elk were not observed using both areas on the same day.

Based on observations made during the winter of 1986-87, elk did not habituate to the limited activity at Graphite Well 2-15 and use of Graphite Hollow continued to be lower than the pre-drilling level. As snow depth increased in January and February, we saw no elk movement from Rock Creek into Graphite Hollow. Elk may have been avoiding the human activity associated with Graphite Well 2-15.

Further monitoring is needed to determine whether decreased use of Graphite Hollow by elk continues. Future monitoring will include documenting the distribution of elk on this winter range and analyzing forage utilization on the Rock Creek winter range to determine whether overgrazing is occurring as a result of elk displacement.

Trend Counts and Movements of Radio Collared Elk

Four elk were radio collared in January-April 1986 (Table 1) and movements between the Rock Creek and Graphite winter ranges were documented. A female calf trapped on January 24, 1986 on Rock Creek was relocated on the east side of Graphite Hollow with 97 other elk on March 4, 1986. She moved back to Rock Creek later in March where her collar slipped off. A cow elk collared on Rock Creek moved east along Rock Creek and died about 200 yards from the bottom of the Rock Creek drainage. Her radio signal indicated she died in late February. There were puncture wounds at the base of her skull indicating she died from mountain lion predation.

The two remaining elk moved off the Rock Creek/Graphite Hollow winter range onto Packsaddle Ridge, and were west of Snider Basin in the LaBarge Creek drainage in June. They summered on the east side of Mount Coffin in the Wyoming Range (T30N, R116W, Sec.2). Neither of these elk returned to the Rock Creek/Graphite Hollow winter range. The cow with radio collar 172.520 moved to the south end of Porcupine Ridge along Hobbie Creek (T28N, R118W, Sec. 36) in Hunt Area 104. She was with 33 other elk on December 12, 1986. Radio 172.550 wintered on Big Fall Creek on the northwest side of Deadline Ridge (T28N, R118W, Sec. 29) with her calf (Hunt Area 94), in an area not normally used as winter range. If snow pack had been normal in 1986-87, this elk would probably have moved onto the Rock Creek/Graphite Hollow winter range or to winter range south of LaBarge Creek. The trend count of 168 in 1986-87 was the second lowest on record for this winter range. The trend count has declined for the last 3 years (Table 5). The decline was correlated with field development. The decline in the trend count might be due to range abandonment because of increased human activity or to increased harvest because of increased access throughout the well field. However, we saw no increase in harvest within the well field during field checks and many hunters complained they could not find elk within the wellfield in areas where elk had been harvested in the past. Additional monitoring to see whether elk resume use of the winter range may help confirm this.

In 1985-86 the elk trend count in Hunt Area 102, directly south of Rock Creek/Graphite Hollow was about 200 more than expected (Personal Communication, Elaine Raper, District IV Wildlife Management Coordinator). At the same time, the January 1986 trend count for Rock Creek/Graphite Hollow was 54 elk less than the mean of the last 4 years (Table 6). It is highly probable that some of the increase in hunt area 102 was from elk abandoning the Rock Creek/Graphite Hollow winter range. In 1986-87 the Rock Creek/Graphite Hollow winter range trend count was again low, 70 elk

less than the previous 6 year average trend count of 238. Some of the elk from Rock Creek/Graphite Hollow wintered on Hobbie Creek, as indicated by the location of a radio-collared elk, but the small sample size makes any stronger conclusions difficult.

Elk responded to drilling activity on the Rock Creek/Graphite Hollow winter range by abandoning a portion of the Graphite Hollow winter range. Pre-drilling elk distribution indicates this was the preferred portion of the winter range, with a mixture of forage, hiding cover and thermal cover. Forage production based on ocular estimates was much higher in Section 21 than 17, where elk were frequently observed feeding from 1979-1986. In Section 21, a mix of grasses, forbs and shrubs were present. In Section 17, the forage was mostly grasses exposed on wind-swept snow free slopes. Snow on the Graphite Hollow portion of the winter range was less than on Rock Creek due to wind action and topography. Rock Creek is a deep drainage with steep side slopes while Graphite Hollow is rolling terrain. Snow accumulation in the lower portion of Rock Creek is much greater than on Graphite Hollow. Given the extent of snow free slopes and the total acreage in Rock Creek and Graphite Hollow, there is much more forage available in Graphite Hollow. On Rock Creek, elk find forage similar to that on Graphite Hollow in Section 21 only when they descend onto the lower elevations of Rock Creek.

The winters between 1979 and 1986-87 ranged from extremely mild (1980-81) to severe (1983-84). The winter of 1984-85 was mild but the winter of 1985-86 was severe with major snow storms and extended cold temperatures. The winter of 1986-87 was also mild. In years before drilling, elk were found throughout the Rock Creek and Graphite Hollow winter ranges. In winters when there was drilling, even when conditions were most severe, few elk were found in Rock Creek.

In the winter of 1984-85, December 1985, and in the winter of 1986-87, elk use of the winter range at the head of Graphite Hollow was not the same as use from 1979-1984. From 1979-1984, there was no activity at the well site. A significant portion of the winter range was not used in the winters of 1984-85, 1985-86 or 1986-87, probably due to human activity associated with Graphite Well 2-15. Following drilling in January 1986 and prior to production, elk returned to Section 21.

Elk distribution is dynamic and elk respond readily to harassment. One blue-collared elk marked in February, 1984 at Finnegan Feedground was observed on LaBarge Creek in December 1985. Another elk, trapped at Finnegan feedground as a calf, was retrapped 2 years later on Rock Creek, indicating there is some elk movement to LaBarge Creek from north of the Rock Creek winter range. Movements of the radio collared elk to different winter ranges document the dynamic nature of elk distribution and their mobility in response to disturbance. When winter ranges are abandoned, they may be lost, as happened on Cretaceous Mountain and Hogsback Ridge. These 2 areas historically supported elk in winter, but now, elk only occasionally use them. When elk abandon a winter range and are counted in other herds, such

as Hunt Areas 102 and 104 or on feedgrounds in the rest of area 94, management plans have to be adjusted. For each herd and for each feedground, there is a population objective, and hunting seasons are the prime methods for controlling elk numbers. Hunting seasons are based, in part, on trend counts. When trend counts and associated population estimates are above objective, seasons are set to reduce the number of elk to objective levels by increasing license quotas and or extending season lengths.

When elk leave a herd, as in the case of Rock Creek elk going to Areas 102 and 104 and trend counts indicate the population is above objective, seasons in those areas are adjusted and harvest increased to return that herd to the population objective. The result is not only was a winter range lost, but the total number of elk in western Wyoming is reduced. The elk often do not find some other place to winter. They are killed by hunters or forced into suboptimal habitat and die of starvation or predation.

Riley Ridge Winter Range

Winter access to the Riley Ridge/Reed Ridge/Trail Ridge winter range has been limited because private landowners limited access and roads were not plowed or maintained in winter. The exception to this situation occurred in the winters of 1980-81 and 1981-82 when wells were drilled on Riley Ridge by American Quasar Corporation and since 1984 when Exxon Company U.S.A. began field development on Trail Ridge.

Prior to 1980, 60 to 80 elk usually wintered on Riley Ridge and some wintered on ridges to the south. In the winter of 1980-81, American Quasar Corporation drilled a well on Riley Ridge throughout the winter. That winter, no elk were observed on Riley Ridge, but 80 elk were counted on Reed Ridge. In the winter of 1981-82, American Quasar drilled three more wells on Riley Ridge. That winter, only seven elk were observed on Riley Ridge and no elk were counted on Reed or Trail Ridges. Thirty-four elk were observed on an isolated mesa north of the east end of Dry Piney Creek approximately 12 miles east of Riley Ridge. These elk may have come from Riley Ridge. The whereabouts of other elk from Riley Ridge is unknown. In winters from 1982-83 to 1986-87, 62, 42, 74, 6 and 6 elk, respectively, were seen on Riley Ridge. There was no human activity on this winter range in those years (Table 7).

When one well was drilled on Riley Ridge, elk moved to Reed Ridge and abandoned the winter range on Riley Ridge. In 1981, when three wells were drilled, there was sufficient activity to cause most of the elk to abandon over 6,000 acres of crucial winter range. The physical disturbance consisted of approximately six miles of roads and three well pads, or 62 acres. Using the multiplier of 5 in the Environmental Impact Statement for the Riley Ridge Project, about 310 acres would be expected to be rendered unsuitable for elk. Obviously, in this situation the multiplier is inaccurate, since

6,000 acres were abandoned by elk in 1981. If this was typical of other areas affected by oil/gas activity, the multiplier should have been 97, not 5.

From December through March 3, 1986, no elk were observed on Riley Ridge. On March 4, 6 elk were observed. Ten elk were found on Dry Piney Creek that might have normally wintered on Riley Ridge, and about 40 elk were in a rancher's haystack on Dry Piney Creek. We don't know exactly why elk abandoned the Riley Ridge winter range. But, from May through October there was intense construction activity throughout the well field from Trail Ridge to Deadline Ridge as wells were drilled, pipelines were assembled and buried, and powerlines were erected. Reclamation work continued up through mid-October. This activity may have altered traditional distribution and movements of elk on summer ranges. Subsequent snow storms in November may have prohibited elk from returning to winter ranges on Riley Ridge. It was probably this combination of construction activities and deep snows prohibiting elk from reaching to and utilizing traditional winter ranges that caused elk to winter on Dry Piney Creek. By May 1, 1986, 44 elk were observed on Riley Ridge and 17 elk were on Reed Ridge.

In the winter of 1986-87, no elk were seen on Riley Ridge during helicopter or fixed-wing surveys until 6 elk were found on January 30, 1987. Between January 30 and April 15, 1987, 50 to 80 elk were on North Mountain, approximately 1.5 miles north of Riley Ridge and north of south Piney Creek. After January 30, no elk were observed on Riley Ridge. Elk have been displaced to North Mountain from Riley Ridge this winter and have moved toward Coal Creek on the west side of North Mountain. These elk may move into Snider Basin to have their calves, but do not appear to be returning via Riley Ridge and may not return to Snider Basin at all.

Lake Ridge Calving Area

Up to 140 elk in a group were seen on Lake Ridge from May 1979 through July 1983, prior to development of the LaBarge Project (Table 8). From May through July 1984, when construction, surveying, and drilling was occurring, only 11 cow and 2 calf elk were on Lake, Narrow, and Trail Ridges. On two other flights during this period, no elk were seen on Lake Ridge. On May 19, 1985, twenty-eight elk were observed on Lake Ridge when there was no drilling activity.

During field development, elk use of the Lake Ridge calving area was not as great as use from 1979-1983 prior to field development. On June 14, 1985, 43 elk were counted on Lake Ridge, about one-third the maximum number of elk counted in this area from 1979 - 1983. In 1984, only 28 elk had been counted on Lake Ridge during calving season. This decline in elk numbers can be directly correlated to drilling activity on Lake Ridge, and high counts were made during the time when no drilling occurred. The lowest count occurred while wells were being drilled on this calving area. In 1985, no wells were drilled, and efforts were made to minimize human activities in

the area. However, various types of construction activities, including drilling, pipeline trenching and pipeline assembly occurred on the perimeter of this calving area. Most major construction was completed in 1984, and a road management plan was devised to reduce human activity on this area during calving season. How elk respond to decreased activity still remains to be determined, but only 3 elk were observed on this calving area in May, 1986 while on May 28, 1987, 30 elk were observed using this calving area. It appears that reducing activity on the road has been partially effective since some elk have returned to this area. However, these recent counts are lower than counts made prior to drilling activity. The lower counts may be a result of public use in the area, which was not and is still not restricted.

Snider Basin Calving Area

Drilling Period. Distribution of elk within Snider Basin from May - July, 1984 was monitored by aerial reconnaissance while tracking 21 radio-collared elk from Finnegan Feedground. These elk were part of a separate but related study. No elk were seen in Snider Basin until July 13, 1985, when 76 elk were observed. Five transects consisting of ten 0.01-acre plots were searched for elk fecal pellets on July 13, 1984, and compared to pellet groups counted along the same transects in 1979 and 1980. In 1979, 1980, and 1984, 35, 30 and 5 pellet groups, respectively, were found along these transects. Combined with aerial reconnaissance information, these data indicate few elk calved in Snider Basin in 1984.

From February 1982 - March 1984, 116 elk were ear-tagged, including 21 which were radio-collared and 54 which were neck-banded on the Finnegan Feedground. In 1979 and 1980 there was elk movement into Snider Basin from Finnegan Feedground. In the fall of 1982, two ear-tagged elk were harvested in or just south of Snider Basin. Since then, none of the radio-collared elk and no neck-banded elk have been observed or harvested in Snider Basin. Surveying, construction, and new drilling activity around Snider Basin in 1983 and 1984 delayed movement of elk into the Basin from the east and south. Road traffic into Snider Basin probably kept elk from moving into the Basin from the northeast.

Post-drilling. Elk calving activity in Snider Basin has increased since drilling activity has been completed. In 1984, drilling rigs were operating at both well sites, and no elk were observed in the basin until July 13. Drilling on the Lake Ridge 2-27 and 3-15 locations in Snider Basin was completed before elk started calving in 1985, and there was no other construction activity on these sites until July. In 1985, elk were observed in the basin throughout the calving period, and the highest 1 day count was 13 elk.

Six transects consisting of ten 0.01-acre plots were searched for pellet groups on July 10, 1986, and results were compared to results along the same transects in 1979, 1980, 1984, and 1985. Seven pellet groups were found in 1986, compared to 37, 30, 5 and 49 in 1979,

1980, 1984 and 1985, respectively. In 1985, 3 cattle scats were observed and in 1986, 40 cattle scats were observed on the transects. Cattle use in the area may have forced elk to redistribute within the basin and biased the 1986 results. Elk use of Snider Basin in 1985, based on pellet groups, was similar to that observed in 1979 and 1980, and elk responded positively to the disturbance free area.

Other Critical Winter Ranges

Pinegrove, Narrow, and Lake Ridges were crucial elk winter range in the early 1970s. Elk were scattered throughout the south-facing and windswept ridges from Pinegrove to Riley Ridge (Pers. Comm. Chuck Thornton, Big Piney Game Warden). Elk have not been observed in winter on Pinegrove, Narrow, or Lake Ridges for the last 7 years. Gas field development has increased on Pinegrove and Narrow Ridges, with wells maintained throughout the year. This winter activity has been sufficient to cause elk to abandon this portion of their winter range.

Elk use of Cretaceous Mountain in winter has also decreased. Elk have been observed on this mountain in only 1 year out of 7. Oil and gas field development throughout this crucial winter range is believed to have reduced elk use.

Hogsback Ridge is on the east end of the Graphite Hollow winter range. Elk have been observed on this crucial winter range in only 3 out of 7 years on this crucial winter range. Oil and gas wells are found throughout the Hogsback Ridge. Cretaceous Mountain and Hogsback Ridge would be excellent elk winter range without the human activity in the area in winter.

DISCUSSION AND SUMMARY

Gas exploration and field development of gas reserves in the Riley Ridge Gas Field have caused marked changes in elk distribution. On crucial elk winter range on Riley Ridge, a shift in distribution caused by one well was followed by abandonment of 6,000 acres of winter range when three wells were drilled in the same area. Elk have returned to this winter range since drilling ceased, but elk use has been unpredictable. Winter use of other historic crucial winter ranges (e.g. Pinegrove Ridge, Hogsback Ridge, Cretaceous Mountain) has declined drastically, and is not expected to increase soon. Oil and/or gas fields are being maintained on these areas with no accommodation for elk behavioral or habitat needs in winter.

Drilling adjacent to the Graphite Hollow winter range has shifted elk distribution to Rock Creek, even with limitations on human activity. Future monitoring may determine whether this is a permanent displacement.

The number of elk was reduced and their distribution was different on the Rock Creek/Graphite Hollow winter range during field development

and production than before drilling. After the completion of Graphite Well 2-15 in December 1985, some elk returned to the head of Graphite Hollow.

The Rock Creek/Graphite Hollow winter range and the Riley Ridge winter range support the last two sizeable groups of elk that winter on native forage in the Piney elk herd (i.e. they are not supported by feedgrounds). We do not know whether elk use of these 2 winter ranges will return to pre-drilling levels.

Elk calving areas have also been affected. Elk temporarily abandoned the Lake Ridge calving area 1984 when intense drilling related activity occurred throughout the area. Since 1985, the number of elk on this calving area has been less than half the number observed prior to field development. The number of elk observed calving in Snider Basin was higher, though, in 1985 when no drilling occurred than in 1984 when 2 wells were drilled. Road traffic, construction, and drilling activity have affected and apparently reduced the usual movement of elk from Finnegan Feedground into Snider Basin.

The changes discussed above concern only a small portion of the 48,000 acre well field to be developed. Only 14 wells were drilled by 1984 and 17 by 1987, including constructing 3 manifold sites and a dehydration facility. There were 64 wells planned for the LaBarge Project. While elk have often been able to find habitats away from human activity to date, the cumulative effects of continued development of the LaBarge Project and other leases may lead to complete abandonment of historic ranges and a decline in the elk population. To prevent this, Exxon Company, U.S.A. and other companies working in the Riley Ridge Gas Field should commit to road closures, placement of wells and roads outside crucial habitats, or at least reduced human activity at wells in these habitats. To maintain elk numbers, habitat improvement projects will undoubtedly be necessary, or habitat degradation and increased mortality will occur as elk are forced into areas they would otherwise not use. Some of this could be reduced by proper restrictions on seasonal activity around wells.

Some elk have returned to habitats from which they were displaced by drilling activity. The Game and Fish Department intends to continue monitoring elk distribution in relation to oil-gas development activities for the next 3 years. If we can determine which changes in human activity led to elk returning to some of these areas, we propose similar changes for all oil-gas activity to reduce impacts. This is going to be important when LaBarge Phase II begins and human activity increases again, or when the world oil price increases, triggering increased oil-gas activity. Implementation of measures to decrease wildlife impacts should help reduce concern and resultant adversarial situations which nearly always result during intense oil-gas development in formerly undeveloped areas.

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FIGURE 1. Piney elk herd unit seasonal distribution map.



FIGURE 2. Locations of wells, roads and pellet transects within Snider Basin, Wyoming Range.

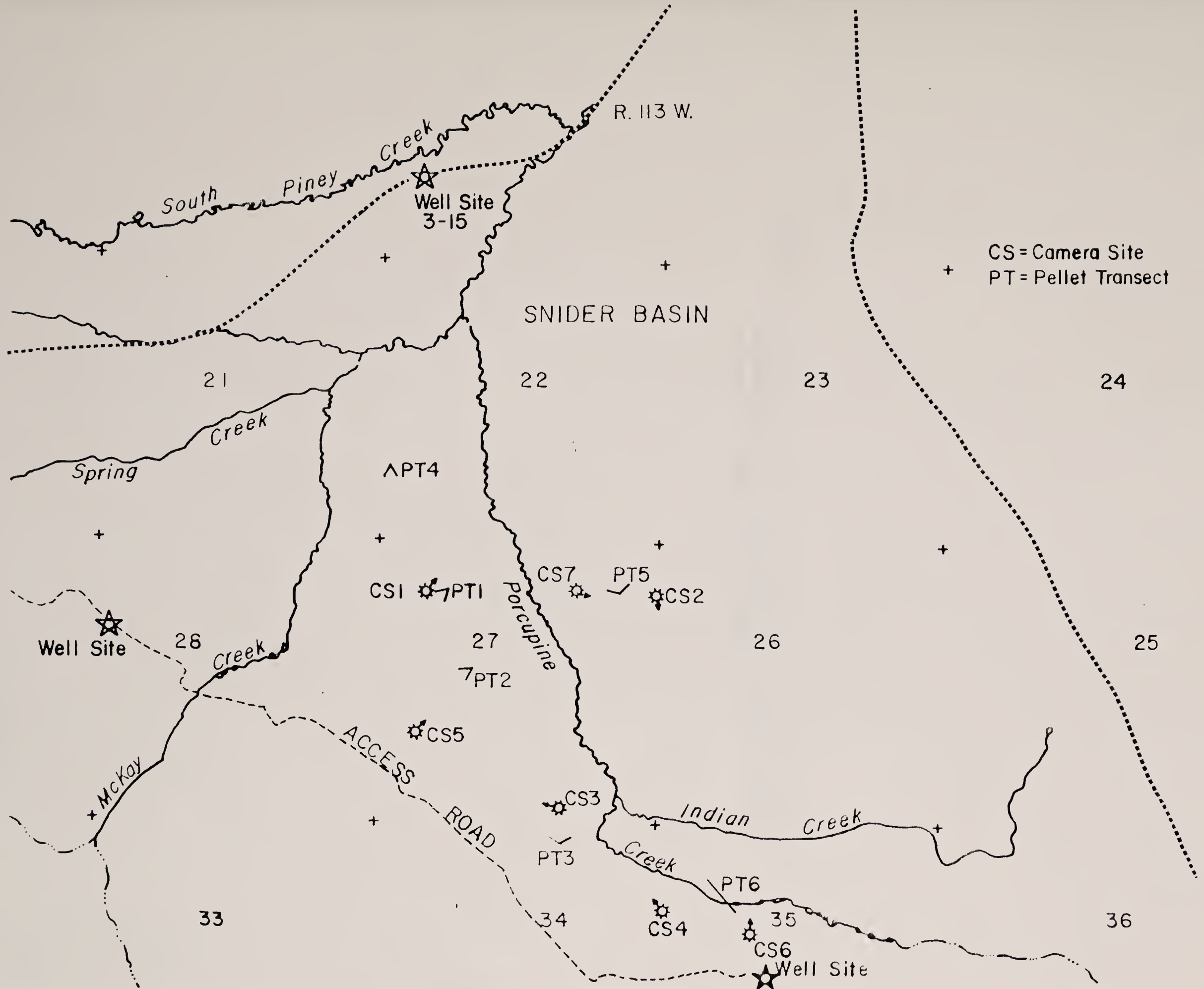


FIGURE 3. Locations of elk groups sighted on aerial or ground reconnaissance of Rock Creek and Graphite Hollow October 31, 1984 to May 6, 1987.

50
(1/2 Mi.)

DEHYDRATION
SITE

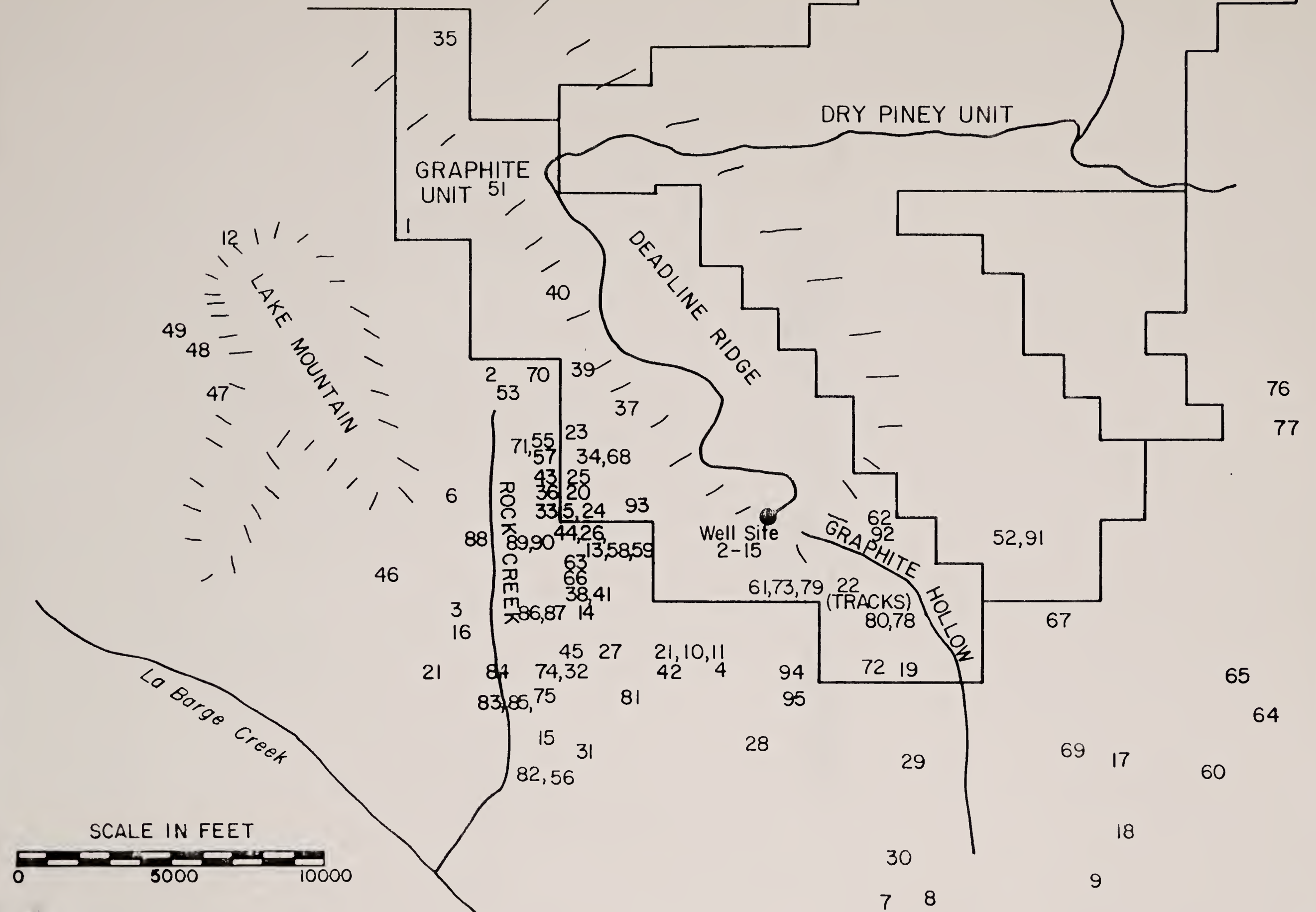


FIGURE 4. Locations of elk by aerial and ground reconnaissance in Graphite Hollow, Rock Creek, and on Lake Mountain from November 1 - May 19, 1979-84.

● - PROPOSED SITE FOR WELL 2-15

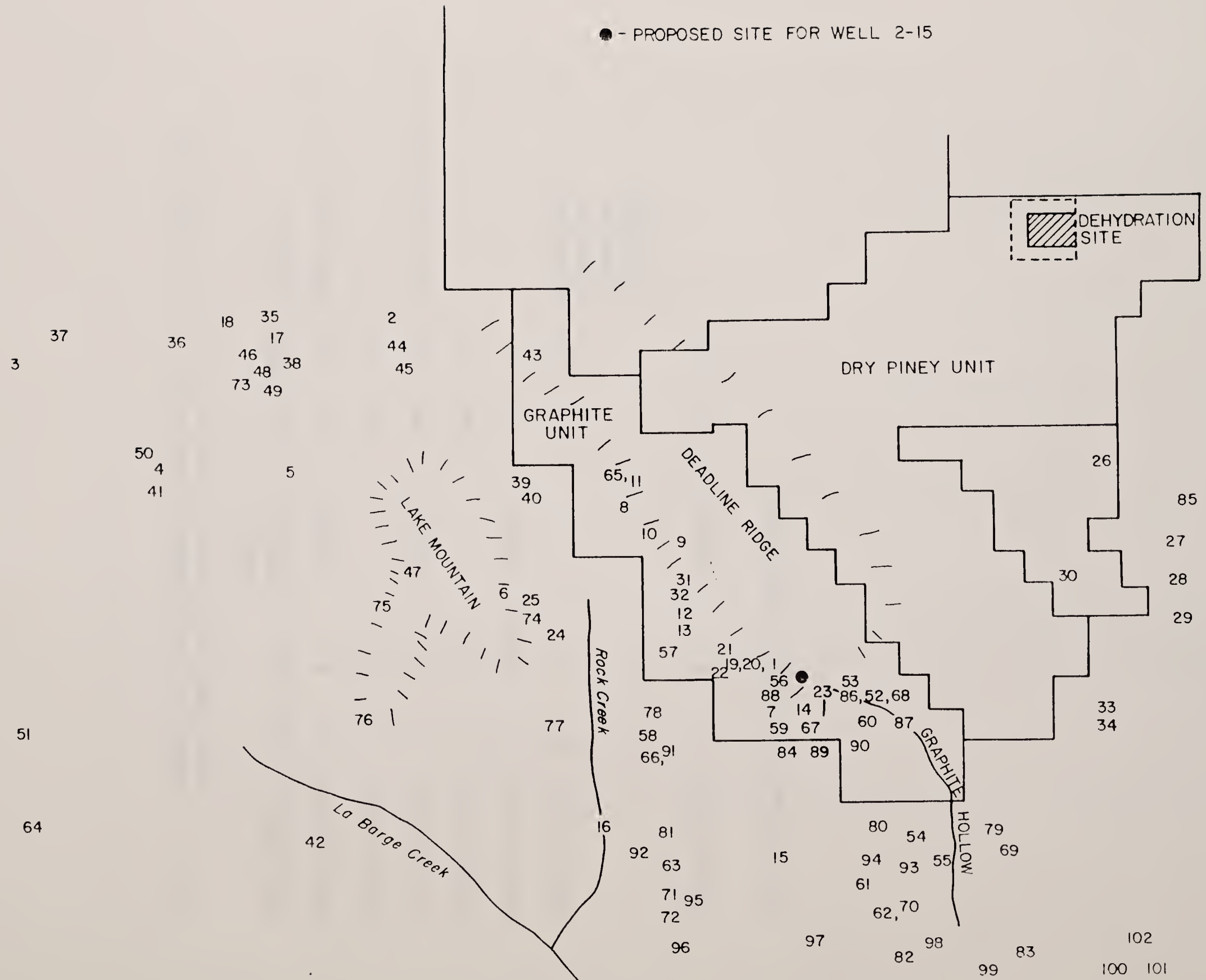


Table 1. Summary of elk trapped on Rock Creek in conjunction with Exxon monitoring program January 18 - April 5, 1986.

| Tag Numbers | Sex | Age | Radio Frequency | Bled* | Date | Comments |
|-------------|-----|-------|--------------------|-------|------|---|
| G4438,G4439 | F | A | 172.460 | Yes | 1/19 | Died later |
| G4440,G4441 | M | C | | Yes | 1/20 | |
| G2999,G3000 | F | C | 172.580 | Yes | 1/24 | Collar fell off |
| G4442,G4443 | M | C | | Yes | 1/26 | |
| G4445,G4446 | F | Yrlg. | 172.550 | Yes | 1/27 | |
| G2914,G2915 | M | A | | No | 1/29 | Recapture- tagged at Finnegan Feedground on 3/16/84 |
| G4448,G4449 | F | A | 172.520 | No | 2/6 | |

*All tested negative for brucellosis.

Table 2. Number of elk observed on crucial winter range in Rock Creek and Graphite Hollow during aerial reconnaissance in 1979-1984 and aerial and ground reconnaissance in 1984-85, 1985-86 and 1986-87.

| <u>Period</u> | <u>Trend*</u> <u>Count</u> | <u>Rock Creek</u> | | <u>Graphite Hollow</u> | |
|-------------------------------|-------------------------------|-------------------|------------------|------------------------|------------------|
| | | <u>Groups</u> | <u>Total Elk</u> | <u>Groups</u> | <u>Total Elk</u> |
| Pre-drilling (1979-84) | 275 | 24 (32%) | 274 (20%) | 52 (76%) | 1,066 (80%) |
| Drilling (1984-85) | 198 | 32 (60%) | 912 (61%) | 15 (32%) | 572 (39%) |
| Completion (Dec.1985) | 203 | 3 (75%) | 150 (86%) | 1 (25%) | 25 (14%) |
| No Activity (Jan-May 1986) | 203 | 14 (64%) | 355 (55%) | 8 (36%) | 293 (45%) |
| Production (1986-87) | 168 | 1 (33%) | 168 (76%) | 2 (67%) | 52 (24%) |

*Trend count is the highest count used in management decisions.

Table 3. Date, location, and number of elk observed during monitoring of elk distribution from October 31, 1984 - May 6, 1987 in Rock Creek and Graphite Hollow in the Piney Elk Herd in conjunction with Exxon Company, U.S.A. LaBarge Project.

| Date | Map Number on Figure 3 | Section | Location Township | Range | Number Elk | Comments |
|----------|---------------------------|---------|----------------------|-------|---------------|-------------------|
| 10/31/84 | 1 | SWNE 12 | 27 | 115 | 15 | Ground Rock Creek |
| 11/10/84 | 2 | NENW 17 | 27 | 114 | 50 | Ground Rock Creek |
| | 3 | SESE 24 | 27 | 114 | 14 | Graphite |
| 12/18/85 | 4 | SESW 21 | 27 | 114 | 3 | Ground Graphite |
| 01/03/85 | 5 | SWSE 17 | 27 | 114 | 47 | Aerial Rock Creek |
| | 6 | NENE 24 | 27 | 115 | 1 | Graphite |
| | 7 | 34 | 27 | 114 | 7 | Graphite |
| | 8 | 34 | 27 | 114 | 37 | Graphite |
| | 9 | NE 35 | 27 | 114 | 28 | Graphite |
| | 10 | 21 | 27 | 114 | 39 | Graphite |
| | 11 | SWSW 21 | 27 | 114 | 1 | Graphite |
| | 12 | 11 | 27 | 114 | 5 | Graphite |
| 01/10/85 | 13 | NENE 20 | 27 | 114 | 60 | Aerial Rock Creek |
| | 14 | NWSE 20 | 27 | 114 | 35 | Rock Creek |
| | 15 | SENE 29 | 27 | 114 | 7 | Rock Creek |
| | 16 | SENE 24 | 27 | 115 | 5 | Rock Creek |
| | 17 | SENE 26 | 27 | 114 | 24 | Graphite |
| | 18 | SESE 26 | 27 | 114 | 72 | Graphite |
| 01/09/85 | 19 | SWSE 22 | 27 | 114 | 50 | Ground Graphite |
| | 20 | SWSE 17 | 27 | 114 | 35 | Aerial Rock Creek |
| | 21 | NE 25 | 27 | 115 | 20 | Rock Creek |
| | 22 | SWNW 22 | 27 | 114 | 25 | Graphite |
| | 23 | NWSE 17 | 27 | 114 | 75 | Rock Creek |
| | 24 | SWSW 17 | 27 | 114 | 40 | Rock Creek |
| | 25 | SW 17 | 27 | 114 | 25 | Rock Creek |
| 02/28/85 | 26 | NWNE 20 | 27 | 114 | 31 | Rock Creek |
| 03/04/85 | 27 | SE 20 | 27 | 114 | 25 | Rock Creek |
| | 28 | SWNE 28 | 27 | 114 | 24 | Graphite |
| 03/05/85 | 29 | NWSE 27 | 27 | 114 | 47 | Graphite |
| | 30 | NWNE 34 | 27 | 114 | 130 | Graphite |
| 03/20/85 | 31 | SWNE 29 | 27 | 114 | 11 | Aerial Rock Creek |
| | 32 | SWSE 20 | 27 | 114 | 4 | Rock Creek |
| | 33 | SWSE 17 | 27 | 114 | 30 | Rock Creek |
| | 34 | NESE 17 | 27 | 114 | 79 | Rock Creek |
| 04/05/85 | 35 | NENE 1 | 27 | 115 | 30 | Rock Creek |
| | 36 | SWSE 17 | 27 | 114 | 11 | Rock Creek |

| Date | Map Number on Figure 3 | Location Section Township Range | Number Elk | Comments |
|----------|---------------------------|------------------------------------|---------------|--------------------------------------|
| 04/06/85 | 37 | SENE 17 27 114 | 20 | Rock Creek |
| | 38 | SWNE 20 27 114 | 4 | Rock Creek |
| | 39 | NWNE 17 27 114 | 50 | Rock Creek |
| | 40 | NESW 8 27 114 | 25 | Rock Creek |
| | 41 | NWSE 20 27 114 | 11 | Rock Creek |
| | 42 | SWSW 21 27 114 | 30 | Graphite |
| 04/24/85 | 43 | SESW 17 27 114 | 30 | Rock Creek |
| | 44 | NENW 20 27 114 | 3 | Rock Creek |
| | 45 | SWSE 20 27 114 | 25 | Rock Creek |
| | 46 | NESW 24 27 115 | 4 | Rock Creek |
| | 47 | SENW 14 27 115 | 5 | Rock Creek |
| | 48 | NW 14 27 115 | 9 | Rock Creek |
| | 49 | NW 14 27 115 | 7 | Rock Creek |
| 05/19/85 | 50 | SWSE 27 28 115 | 1 | Deadline Ridge |
| | 51 | NWNW 8 27 114 | 6 | Rock Creek |
| | 52 | NW 23 27 115 | 3 | Lake Mtn. |
| | 53 | NWNW 17 27 114 | 5 | Rock Creek |
| 12/26/85 | 53 | SENE 20 27 114 | 100 | Rock Creek |
| | 54 | SWSE 17 27 114 | 42 | Rock Creek |
| | 55 | NESW 12 27 115 | 8 | Rock Creek |
| | 56 | 36 27 114 | 25 | Graphite-east |
| 01/04/86 | 57 | 8 27 114 | 27 | Rock Creek |
| | 58 | NE 20 27 114 | 59 | Rock Creek |
| | 59 | NE 20 27 114 | 90 | Rock Creek |
| | 60 | 25 27 115 | 1 | Lake Mountain |
| | 61 | SWNE 21 27 114 | 26 | Graphite <0.5 mile from well site |
| 01/29/86 | 62 | NENW 22 27 114 | 3 | Graphite >0.5 mile from well site |
| | 63 | NE 20 27 114 | 54 | Rock Creek |
| | 64 | NE 25 27 115 | 7 | Lake Mountain |
| | 65 | SWSE 24 27 115 | 25 | Lake Mountain |
| | 66 | SWNE 20 27 114 | 15 | Rock Creek |
| | 67 | 23 27 115 | 1 | Lake Mountain |
| 03/04/86 | 68 | NWSE 17 27 114 | 45 | Rock Creek |
| | 69 | SWNE 26 27 114 | 98 | Graphite-east |
| | 70 | NENW 17 27 114 | 2 | Rock Creek |
| | 71 | NESE 17 27 114 | 15 | Rock Creek |
| 04/17/86 | 72 | SESW 22 27 114 | 11 | Graphite >1.0 mile from well site |
| | 73 | SENE 21 27 114 | 75 | Graphite <0.5 mile from well site |
| | 74 | SESW 20 27 114 | 6 | Rock Creek |
| | 75 | NENW 29 27 114 | 21 | Rock Creek |
| | 76 | NE 13 27 115 | 1 | Rock Creek |

| Date | Map Number on Figure 3 | Location Section Township Range | Number Elk | Comments |
|----------|---------------------------|------------------------------------|---------------|--|
| | 77 | SENE 13 27 115 | 3 | Rock Creek |
| 05/01/86 | 78 | 22 27 114 | 45 | Graphite 1.0 mile east of well |
| | 79 | SWNE 21 27 114 | 2 | Graphite 0.5 mile from well site |
| | 80 | NESW 22 27 114 | 33 | Graphite 1 mile east of well site |
| | 81 | NENE 29 27 114 | 16 | Rock Creek |
| | 82 | NESW 29 27 114 | 1 | Rock Creek |
| 05/01/86 | 83 | NWNW 29 27 114 | 6 | Rock Creek |
| | 84 | SWSW 20 27 114 | 10 | Rock Creek |
| | 85 | NWNW 29 27 114 | 10 | Rock Creek |
| | 86 | NESW 20 27 114 | 4 | Rock Creek |
| | 87 | NESW 20 27 114 | 5 | Rock Creek |
| 05/16/86 | 88 | NWNW 20 27 114 | 25 | Rock Creek |
| | 89 | NWNW 20 27 114 | 1 | Rock Creek |
| | 90 | NENW 20 27 114 | 1 | Rock Creek |
| | 91 | NWNW 23 27 114 | 9 | Graphite 1.5 miles east of well |
| | 92 | NENW 22 27 114 | 2 | Graphite 1.0 mile SE of well |
| 02/17/87 | 93 | SESE 17 27 114 | 168 | Rock Creek |
| 03/21/87 | 94 | SESE 21 27 114 | 23 | Graphite <1.0 mile south of well |
| | | | | 04/15/87 95 NENE 28 27 114 29 Graphite 1.0 mile south of well Miscellaneous reports of elk on Graphite and Rock Creek Drainages: |
| 03/05/85 | 96 | NE 22 27 114 | 30-50 | Drillers on rig saw elk about 0.5 |

| Date | Map Number on Figure 3 | Section | Location Township | Range | Number Elk | Comments |
|----------|---------------------------|---------|----------------------|-------|---------------|--|
| | | | | | | mile east of rig. Elk in area from 2/15 - 2/28. Tracks seen on 2/15 - not seen on 2/28. |
| 03/18/85 | 97 | 17 | 27 | 114 | 115 | Jahnke-Rock Creek |
| 11/12/84 | 98 | 29 | 27 | 114 | 2 | Jahnke-Rock Creek |
| 11/17/84 | 99 | 17 | 27 | 114 | 38 | Jahnke-Rock Creek |

Table 4. Sightings of elk by aerial and ground reconnaissance in Graphite Hollow, Rock Creek and on Lake Mountain from November 1 - May 19, 1979-84. Data were collected while conducting routine surveys, aerial trend counts and classification counts.

| Date | Map Number on Figure 4 | Section | Township | Range | Number Elk |
|----------|---------------------------|----------|----------|-------|------------|
| 04/27/79 | 1 | 16 | 27 | 114 | 9 |
| | 2 | 2 | 27 | 115 | 86 |
| | 3 | 5 | 27 | 117 | 18 |
| | 4 | 9 | 27 | 115 | 32 |
| | 5 | 10 | 27 | 115 | 3 |
| | 6 | 13 | 27 | 115 | 5 |
| 02/12/80 | 7 | 21 | 27 | 114 | 5 |
| 04/27/80 | 8 | 8 | 27 | 114 | 2 |
| | 9 | SE 8 | 27 | 114 | 1 |
| | 10 | 8 | 27 | 114 | 24 |
| | 11 | 8 | 27 | 114 | 26 |
| | 12 | E1/2, 17 | 27 | 114 | 8 |
| | 13 | E1/2, 17 | 27 | 114 | 8 |
| | 14 | 21 | 27 | 114 | 14 |
| | 15 | 28 | 27 | 114 | 35 |
| | 16 | NW 29 | 27 | 114 | 2 |
| | 17 | 3 | 27 | 115 | 2 |
| | 18 | NW 3 | 27 | 115 | 20 |
| 05/04/80 | 19 | SW 16 | 27 | 114 | 6 |
| | 20 | SW 16 | 27 | 114 | 15 |
| | 21 | SW 16 | 27 | 114 | 11 |
| | 22 | SW 16 | 27 | 114 | 24 |
| | 23 | NE 21 | 27 | 114 | 2 |
| | 24 | SE 13 | 27 | 115 | 1 |
| | 25 | 13 | 27 | 115 | 9 |
| 05/19/80 | 26 | NW 12 | 27 | 114 | 3 |
| | 27 | SE 12 | 27 | 114 | 5 |
| | 28 | NE 13 | 27 | 114 | 15 |
| | 29 | E1/2, 14 | 27 | 114 | 8 |
| | 30 | NE 14 | 27 | 114 | 8 |
| | 31 | NE 17 | 27 | 114 | 3 |
| | 32 | NE 17 | 27 | 114 | 3 |

| Date | Map Number on Figure 4 | Section | Township | Range | Number Elk |
|----------|---------------------------|---------|----------|-------|------------|
| | 33 | NW 24 | 27 | 114 | 4 |
| | 34 | NW 24 | 27 | 114 | 1 |
| | 35 | N1/2, 3 | 27 | 115 | 6 |
| | 36 | NE 4 | 27 | 115 | 1 |
| | 37 | 5 | 27 | 115 | 1 |
| | 38 | 3 | 27 | 115 | 8 |
| 11/25/80 | 39 | 12 | 27 | 115 | 6 |
| | 40 | 12 | 27 | 115 | 1 |
| 03/01/81 | 41 | SE 9 | 27 | 115 | 35 |
| | 42 | NESE 27 | 27 | 117 | 3 |
| | 43 | 1 | 27 | 115 | 4 |
| | 44 | 2 | 27 | 115 | 78 |
| | 45 | 2 | 27 | 115 | 2 |
| | 46 | 3 | 27 | 115 | 48 |
| | 47 | 14 | 27 | 115 | 3 |
| 05/15/81 | 48 | 3 | 27 | 115 | 2 |
| | 49 | 3 | 27 | 115 | 3 |
| | 50 | 9 | 27 | 115 | 3 |
| | 51 | 20 | 27 | 115 | 6 |
| 01/16/82 | 52 | 22 | 27 | 114 | 42 |
| | 53 | 22 | 27 | 114 | 80 |
| | 54 | 27 | 27 | 114 | 26 |
| | 55 | 27 | 27 | 114 | 5 |
| | 56 | 16 | 27 | 114 | 23 |
| | 57 | 17 | 27 | 114 | 42 |
| | 58 | 20 | 27 | 114 | 29 |
| | 59 | 21 | 27 | 114 | 49 |
| | 60 | 22 | 27 | 114 | 48 |
| | 61 | 27 | 27 | 114 | 50 |
| | 62 | 27 | 27 | 114 | 20 |
| | 63 | 29 | 27 | 114 | 13 |
| 11/03/82 | 64 | 29 | 27 | 115 | 20 |
| 01/13/83 | 65 | 8 | 27 | 115 | 4 |
| | 66 | 20 | 27 | 114 | 17 |
| | 67 | 21 | 27 | 114 | 10 |
| | 68 | 22 | 27 | 114 | 34 |
| | 69 | 26 | 27 | 114 | 4 |
| | 70 | 27 | 27 | 114 | 5 |
| | 71 | 29 | 27 | 114 | 2 |
| | 72 | 29 | 27 | 114 | 3 |
| | 73 | 3 | 27 | 115 | 4 |
| | 74 | 13 | 27 | 115 | 13 |
| | 75 | 14 | 27 | 115 | 14 |
| | 76 | 23 | 27 | 115 | 28 |
| | 77 | 24 | 27 | 115 | 16 |
| 04/15/83 | 78 | 20 | 27 | 114 | 2 |
| | 79 | 26 | 27 | 114 | 39 |
| | 80 | 27 | 27 | 114 | 56 |

| Date | Map Number on Figure 4 | Section | Township | Range | Number Elk |
|----------|---------------------------|-------------|----------|-------|------------|
| | | 81 29 | 27 | 114 | 3 |
| | | 82 34 | 27 | 114 | 5 |
| | | 83 35 | 27 | 114 | 17 |
| 01/04/84 | | 84 21 | 27 | 114 | 25 |
| 01/05/84 | | 85 12 | 28 | 114 | 3 |
| | | 86 NW 22 | 27 | 114 | 73 |
| | | 87 22 | 27 | 114 | 21 |
| | | 88 21 | 27 | 114 | 8 |
| | | 89 21 | 27 | 114 | 9 |
| | | 90 22 | 27 | 114 | 5 |
| | | 91 20 | 27 | 114 | 83 |
| | | 92 29 | 26 | 113 | 66 |
| 04/04/84 | | 93 27 | 27 | 115 | 7 |
| | | 94 27 | 27 | 114 | 40 |
| | | 95 SE 29 | 27 | 114 | 25 |
| | | 96 NE 32 | 27 | 114 | 9 |
| | | 97 NE 33 | 27 | 114 | 17 |
| | | 98 NE 34 | 27 | 114 | 50 |
| | | 99 SE 35 | 27 | 114 | 5 |
| | | 100 NWSW 36 | 27 | 114 | 15 |
| | | 101 SESW 36 | 27 | 114 | 20 |
| | | 102 NENW 36 | 27 | 114 | 20 |

Table 5. Numbers of groups of elk and total elk counted within Graphite Hollow or Rock Creek crucial elk winter range.

| <u>Section</u> | <u>Township</u> | <u>Range</u> | <u>1979-1984</u> | | <u>1984-1985</u> | | <u>1985-1986</u> | | <u>1986-1987</u> | |
|----------------|-----------------|--------------|------------------|--------------------|------------------|--------------------|------------------|--------------------|------------------|--------------------|
| | | | <u>Groups</u> | <u>Elk Counted</u> | <u>Groups</u> | <u>Elk Counted</u> | <u>Groups</u> | <u>Elk Counted</u> | <u>Groups</u> | <u>Elk Counted</u> |
| 8 | 27 | 114 | 5 | 57 | 2 | 31 | 1 | 27 | 0 | 0 |
| 17 | 27 | 114 | 5 | 64 | 15 | 650 | 2 | 104 | 1 | 168 |
| 20 | 27 | 114 | 4 | 105 | 9 | 228 | 12 | 368 | 0 | 0 |
| 29 | 27 | 114 | 1 | 114 | 3 | 20 | 5 | 67 | 0 | 0 |
| 21 | 27 | 114 | 9 | 145 | 3 | 53 | 3 | 103 | 1 | 23 |
| 22 | 27 | 114 | 7 | 303 | 2 | 75 | 5 | 94 | 0 | 0 |
| 23 | 27 | 114 | 0 | 0 | 0 | 0 | 1 | 9 | 0 | 0 |
| 28 | 27 | 114 | 1 | 35 | 1 | 24 | 0 | 0 | 1 | 29 |
| 27 | 27 | 114 | 8 | 209 | 1 | 47 | 1 | 98 | 0 | 0 |
| 26 | 27 | 114 | 2 | 43 | 2 | 96 | 0 | 0 | 0 | 0 |
| 34 | 27 | 114 | 2 | 71 | 3 | 174 | 0 | 0 | 0 | 0 |
| 35 | 27 | 114 | 2 | 22 | 1 | 28 | 0 | 0 | 0 | 0 |
| 15 | 27 | 114 | 0 | 0 | 1 | 40 | 0 | 0 | 0 | 0 |
| 16 | 27 | 114 | 5 | 65 | 0 | 0 | 1 | 25 | 0 | 0 |
| 36 | 27 | 114 | 3 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | | | 54 | 1288 | 43 | 1466 | 33 | 895 | 3 | 220 |

Table 6. Groups of elk and number of elk observed within various distances of Well 2-15 at the head of Graphite Hollow.

| Distance from well in miles | November 1-May 19 1979 - 1984 | | | October 31-May 19 1984 - 1985 | | | December 26-May 16 1985 - 1986 | | | December 12-May 6 1986 - 1987 | | |
|--|----------------------------------|---------------|-------------------|----------------------------------|---------------|-------------------|-----------------------------------|---------------|-------------------|----------------------------------|---------------|-------------------|
| | Groups | % of Total | Number Counted | Groups | % of Total | Number Counted | Groups | % of Total | Number Counted | Groups | % of Total | Number Counted |
| Less than 0.5 mile | 11 | 14.5 | 288 | 0 | 0.0 | 0 | 3 | 8 | 103 | 0 | 0.0 | 0 |
| 0.5 to 1.0 mile | 10 | 13.2 | 237 | 2 | 4.3 | 75 | 5 | 13 | 175 | 1 | 25.0 | 23 |
| 1.0 to 1.5 mile | 12 | 15.8 | 261 | 27 | 57.4 | 920 | 11 | 28 | 398 | 2 | 50.0 | 197 |
| 1.5 to 2.0 mile | 16 | 21.0 | 294 | 9 | 19.2 | 165 | 11 | 28 | 91 | 0 | 0.0 | 0 |
| 2.0 to 2.5 mile | 15 | 19.7 | 182 | 4 | 8.5 | 156 | 5 | 13 | 134 | 0 | 0.0 | 0 |
| Greater than 2.5 mile within Graphite and excluding Hogsback | 6 | 7.9 | 78 | 5 | 10.6 | 168 | 4 | 10 | 61 | 1 | 25.0 | 2 |
| Hogsback | 6 | 7.9 | 37 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0 |
| TOTALS | 76 | 100.0 | 1,377 | 47 | 100.0 | 1,484 | 39 | 100.0 | 962 | 4 | 100.0 | 222 |

Table 7. Number of elk observed on winter aerial trend counts on Riley, Reed, and Trail Ridges from 1978-1987.

| <u>Year</u> | <u>Number of Elk</u> | <u>Location</u> | <u>Drilling Activity</u> |
|-------------|--------------------------|-----------------|--------------------------|
| Jan. 1978 | 75 | Riley, Reed | None |
| Feb. 1981 | 80 | Reed | 1 well on Riley |
| Jan. 1982 | 7 | Riley | 3 wells on Riley |
| Jan. 1983 | 62 | Riley | None |
| Jan. 1984 | 44 | Riley | None |
| Mar. 1985 | 74 | Riley | None |
| Mar. 1986 | 6* | Riley, Reed | None |
| Jan. 1987 | 59 | North Mtn. | None |
| Jan. 1987 | 6 | Riley | None |
| Feb. 1987 | 50 | North Mtn. | None |
| Mar. 1987 | 37 | Reed | None |

* 61 elk were counted on May 1, 1986 on Riley and Reed Ridges.

Table 8. Number of elk observed on the Lake Ridge calving area from 1980 to 1987 as determined from ground and aerial reconnaissance.

| Date | Location | | Number of elk | Field Activity |
|---------|--------------|-------------|------------------|---------------------------------|
| 6/17/80 | Sec. 34,35 | T28N, R114W | 55 | None |
| 6/25/80 | Sec. 3 | T29N, R115W | 100 | None |
| 7/09/80 | Sec. 30 | T29N, R114W | 140 | None |
| 5/15/81 | Sec.34 | T28N, R114W | | |
| | Sec.3,4,5,20 | T28N, R114W | 71 | None |
| 5/26/81 | Sec. 5 | T28N, R114W | 46 | None |
| 7/10/82 | NW 11 | T28N, R115W | 130 | None |
| 7/20/83 | Sec. 19 | T29N, R114W | 70 | None |
| 7/28/83 | Sec. 24 | T29N, R114W | 130 | None |
| 6/08/84 | Sec. 34 | T28N, R114W | 13 | Survey and road construction |
| 6/10/84 | Lake Ridge | | 0 | Field development |
| 6/13/84 | Lake Ridge | | 7 | Field development |
| 6/19/85 | Sec. 34 | T28N, R114W | 28 | None |
| 6/15/86 | Sec. 34 | T28N, R114W | 3 | Field development Manifold 9 |
| 6/29/86 | Sec. 34 | T28N, R114W | 12 | Field development Manifold 9 |
| 5/06/87 | Sec. 16 | T28N,R114W | 6 | None |
| | Sec. 21 | T29N,R114W | 14 | None |
| | Sec. 29 | T29N,R114W | 3 | None |
| | Sec. 33 | T29N,R114W | 9 | None |

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